MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 3, 2021/2022

DCP5036 – MICROCONTROLLER TECHNOLOGY

(DEE)

12 AUGUST 2022
9:00 a.m. - 11:00 a.m.
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This question paper consists of 10 pages including the cover page with 4 Questions only.

2. Attempt **ALL** questions. All questions carry equal marks and the distribution of the marks for each question is given.

3. Please write all your answers in the Answer Booklet provided.

Question 1 (25 marks)

a) List out the 4 major components of computer.

[4 marks]

b) State the hexadecimal value of memory location 2AH, after the execution of each of the following instructions.

```
MOV  2AH, #34H
SETB 51H
CLR  54H
```

[1+2+2 marks]

c) Write an assembly program for the following operation.

i. Storing a value of 8EH to Register R2 of Bank 2.

[2 marks]

ii. Multiplying the two values 23H and 7EH.

[2 marks]

d) In a control system, a 32K bytes of external RAM is interfaced to the 8051-microcontroller. Internal ROM is used in the control system. Assume 16K bytes of RAM IC chips are available.

i. Determine the number of required memory blocks

[2 marks]

ii. Determine the address lines for each RAM block

[2 marks]

iii. Determine the size of the data bus

[1 mark]

iv. Draw the block diagram, showing the connections of address, data, and control buses for the system. (Hint: You may use decoder where necessary).

[7 marks]

Continued .....

Question 2 (25 marks)

a) Write the opcodes for the following instructions.

i. MOV A, #25H

[2 marks]

ii. MOV @R1, #6AH

[2 marks]

b) Write the instructions for the following opcodes

i. 75265DH

[2 marks]

ii. D234H

[2 marks]

c) Table 1 shows the instructions of a program in a microcontroller. Fill up the Program Counter (PC), Addressing Mode, Cycles and Hex Codes for every instruction in the table.

Table 1

Program Counter (PC)	Instruction	Addressing Mode	Cycles	HEX Codes
	ORG 0030H			
	MOV A, #00H			
	MOV R1, #01H			
	REP: ADD A, R1			
	INC R1			
	CJNE R1, #0AH, REP			
	MOV R1, 2FH			
	END			

[13 marks]

Continued .....

d) Write an assembly program to implement the logic operation shown in Figure 1. The bit addresses of the labels are given in Table 2.

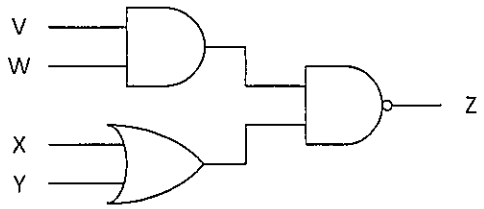


Figure 1

Table 2

Label	Bit Address
V	90H
W	91H
X	92H
Y	93H
Z	94H

[4 marks]

Continued .....

Question 3 (25 marks)

a) An 8051 microcontroller is driven with a crystal frequency of 11.0592MHz. Write a program that generate a square wave on P1.0 with a frequency of 50Hz. The analysis steps must be shown.

i. Without using timer.

[10 marks]

ii. With the use of Timer 0.

[10 marks]

b) An 8051 microcontroller has the following assembly program for serial communication.

```
        ORG 0000H
        ORL   PCON, #80H
        MOV   SCON, #52H
        MOV   TMOD, #20H
        MOV   TH1, #0FDH
        SETB  TR1
AGAIN:  MOV   SBUF, #'9'
HERE:   JNB   TI, HERE
        CLR   TI
        SJMP AGAIN
```

i. What is the value of SMOD?

[1 mark]

ii. Which timer and what serial mode involved in the serial communication?

[2 marks]

iii. Determine the baud rate. Assume that the microcontroller is driven with a crystal frequency of 11.0592MHz.

[2 marks]

Continued .....

Question 4 (25 marks)

a) Explain what is interrupt in programing?

[5 marks]

b) An LED is connected to the P1.4 pin of 8051 microcontroller. The crystal frequency is 12MHz. Write an assembly program with the following requirements.

- LED blinks at the frequency of 1Hz
- Timer 0 interrupt must be used.

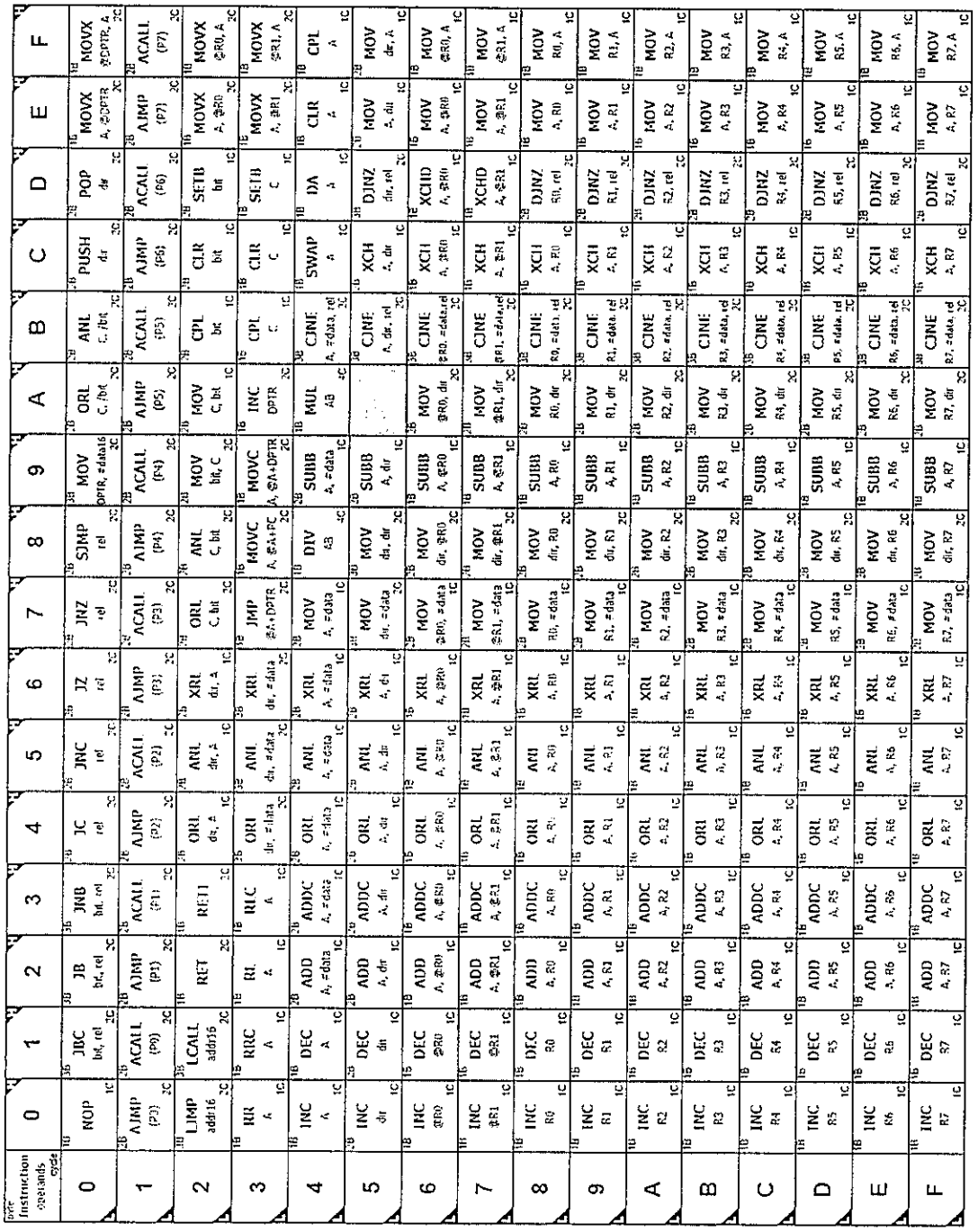
[12 marks]

c) Write an assembly program to increment the value in register R0 by 1 when INT0 is low. The program also decrements the value in register R0 by 1 when INT1 is low. Use edge triggering for the interrupts.

[8 marks]

Continued .....

Appendix A: Opcode Map



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Appendix B: Special Function Register (SFR)

Byte address	Bit address								
FF									
F0	F7	F6	F5	F4	F3	F2	F1	F0	B
E0	E7	E6	E5	E4	E3	E2	E1	E0	ACC
D0	D7	D6	D5	D4	D3	D2	D1	D0	PSW
B8	-	-	-	BC	BB	BA	B9	B8	IP
B0	B7	B6	B5	B4	B3	B2	B1	B0	P3
A8	AF	-	-	AC	AB	AA	A9	A8	IE
A0	A7	A6	A5	A4	A3	A2	A1	A0	P2
99	not bit addressable								SBUF
98	9F	9E	9D	9C	9B	9A	99	98	SCON
90	97	96	95	94	93	92	91	90	P1
8D	not bit addressable								TH1
8C	not bit addressable								TH0
8B	not bit addressable								TL1
8A	not bit addressable								TL0
89	not bit addressable								TMOD
88	8F	8E	8D	8C	8B	8A	89	88	TCON
87	not bit addressable								PCON
83	not bit addressable								DPH
82	not bit addressable								DPL
81	not bit addressable								SP
80	87	86	85	84	83	82	81	80	P0

Continued .....

Appendix C: Bit-Addressable Ram Locations

Byte Address	Bit Address							
2F	7F	7E	7D	7C	7B	7A	79	78
2E	77	76	75	74	73	72	71	70
2D	6F	6E	6D	6C	6B	6A	69	68
2C	67	66	65	64	63	62	61	60
2B	5F	5E	5D	5C	5B	5A	59	58
2A	57	56	55	54	53	52	51	50
29	4F	4E	4D	4C	4B	4A	49	48
28	47	46	45	44	43	42	41	40
27	3F	3E	3D	3C	3B	3A	39	38
26	37	36	35	34	33	32	31	30
25	2F	2E	2D	2C	2B	2A	29	28
24	27	26	25	24	23	22	21	20
23	1F	1E	1D	1C	1B	1A	19	18
22	17	16	15	14	13	12	11	10
21	0F	0E	0D	0C	0B	0A	09	08
20	07	06	05	04	03	02	01	00

Appendix D: TCON (Timer/Counter Control Register)

TF1	TR1	TF0	TR1	IE1	IT1	IE0	IT0
7	6	5	4	3	2	1	0

Appendix E: TMOD

GATE	C/T	M1	M0	GATE	C/T	M1	M0
7	6	5	4	3	2	1	0

Appendix F: IE (Interrupt Enable Register)

EA	--	ET2	ES	ET1	EX1	ET0	EX0
7	6	5	4	3	2	1	0

Appendix G: IP (Interrupt Priority Register)

--	--	PT2	PS	PT1	PX1	PT0	PX0
7	6	5	4	3	2	1	0

Continued .....

Appendix H: Interrupt Vectors

Interrupt	Flag	Vector Address
Reset	RST	0000H
External 0	IE0	0003H
Timer 0	TF0	000BH
External 1	IE1	0013H
Timer 1	TF1	001BH
Serial Port	RI or TI	0023H

Appendix I: SCON (Serial Port Control Register)

SM0	SM1	SM2	REN	TB8	RB8	TI	RI
7	6	5	4	3	2	1	0

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